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(56) Documents cited
GB 2109427 A GB 1289716 A EP 0344318 A1

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(54) A process for forming a grid of polymeric material

(57) A polymeric pre-stretched grid eg for geotextile applications is made by moulding this strips of polymeric material, e.g. polyethylene, these strips are fully stretched by a pre-stretching machine so as to rearrange long keys of polymer molecules thereof to give the strips high tensile strength, then these pre-stretched strips are crossed over each other longitudinally and transversely to the required width and the crossings of the longitudinal and transverse strips are bonded by gluing or hot fusion or otherwise to form a pre-stretched grid. Polypropylene and polyester are other suitable materials.

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1/2

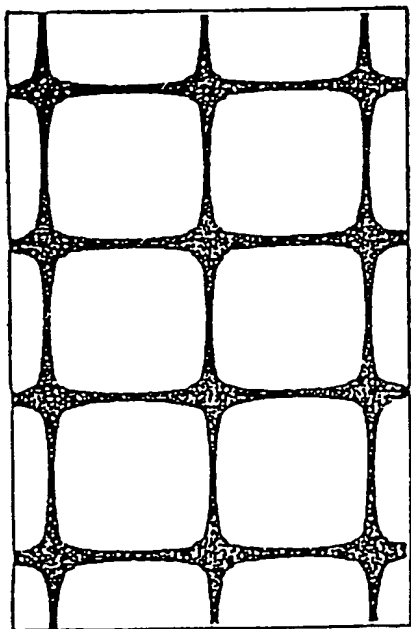


FIG 2

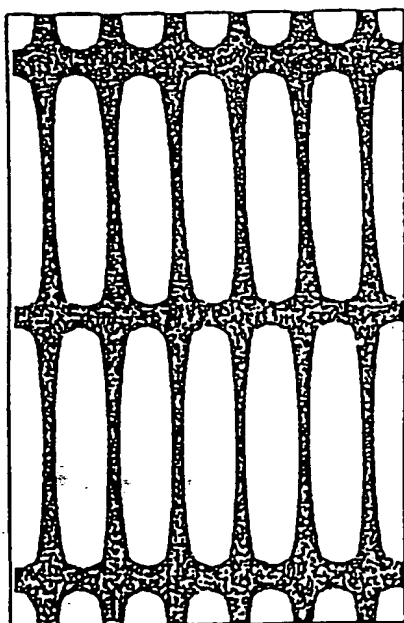


FIG 1



FIG 4

2/2

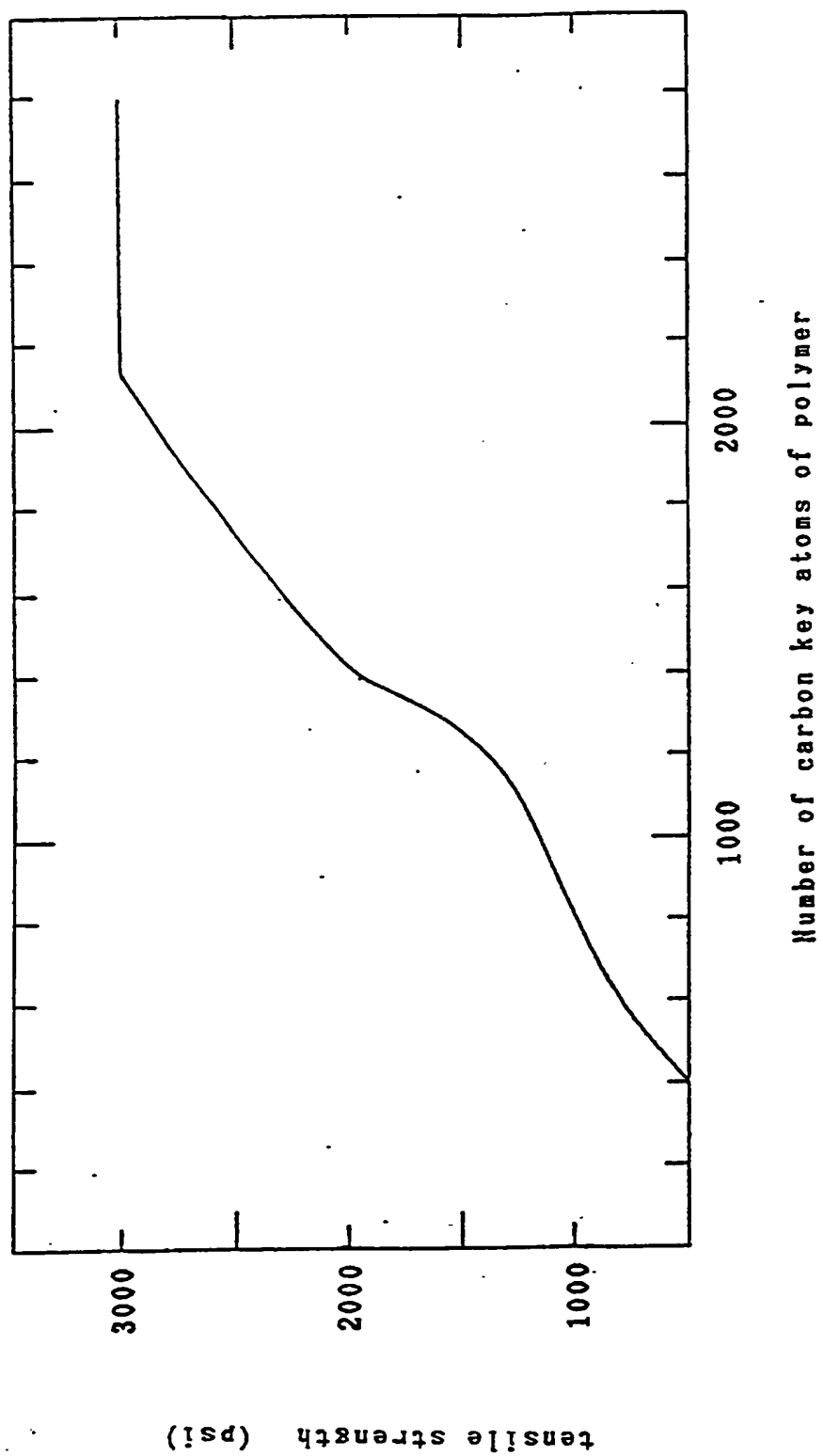


FIG 3

- 1 -

TITLEA Process for Forming a Grid of Polymeric Material

The present invention relates to a process for forming a grid of polymeric material. Such grids are usefully applied to sites in need of water and soil protection such as slopes, retaining walls, protecting walls, protecting banks, breakwaters and wharves.

More than 3,000 years ago pre-stretched earth and clay materials making use of a tensile member were known and materials such as reed and rattan were applied to many large scale earthworks to reinforce clay, brick and granular soil. In 1963 a French civil engineer Henri Vidal developed a modern process for producing pre-stretched earthwork using linear pre-stretched strips and high tensile strength by taking advantage of selected granular soil as determined by his dynamic analysis. The basic concept of producing pre-stretched earth and clay materials was derived from the realisation that the friction force generated from the mutual action - contact face - of both materials, i.e. the soil in pre-stretched earth and the pre-stretched material, can resist the relative movement of these two materials. Thus, the pre-stretched material can prevent the pre-stretched earth material from being laterally deformed and

provide it with a so-called apparent anisotropic cohesion which is proportional to the soil density and the tensile strength of the pre-stretched material. Based on the foregoing principle, the pre-stretched material applied to the filled earth may be in the shape of a plate, grid, network, tube, rope, bar, rod, chain, etc. So far as the nature of the material is concerned, regardless of whether it is an alloy, copper, galvanised carbon steel, stainless steel, reinforced glass fibre, polymer, wood or other material, if it is characterised by suitable tensile strength, friction resistance against the earth or clay material will be achieved, providing considerable durability and economy.

A previously proposed pre-stretched grid of polymeric material is a network polymer with high strength for application to a pre-stretched earth or clay material. The said polymer generally used will be a strong engineering material made from processing specially selected polyolefins and polyesters and particularly suitable for the purpose of long-range pre-stretching without any adverse chemical reaction.

A conventional polymer pre-stretched grid production has to use considerably complex equipment and a prior process is shown as follows:

- (1) To feed polyethylene (or polypropylene or polyethylene

terephthalate or other suitable polymeric material) into a moulding machine for automatic moulding to make a thin polymer sheet;

(2) to feed the thin polymer sheet into a punching machine for evenly punching to form a thin polymer network sheet;

(3) to feed the punched thin polymer network sheet into a sectional pre-stretching machine for longitudinally stretching each lateral row of holes one by one (when stretching, normally the thin polymer network sheet is suitably heated and softened and then stretched in a specific proportion and cooled with cold water or other cooling medium) so as to rearrange the long chains of polymer molecules and provide longitudinally stretched network plies with a considerably high tensile strength and form a one-way pre-stretched grid as shown schematically in Figure 1 of the accompanying drawings;

(4) to feed the one-way pre-stretched grid into another sectional pre-stretching machine for transversely stretching each lateral row of holes one by one so as to provide transversely stretched network plies with a high tensile strength and to form the two-way pre-stretched grid as shown schematically in Figure 2 of the accompanying drawings.

The tensile strength of a typical polymer varies with the length of polymerised carbon chain as shown schematically in Figure 3 of the accompanying drawings; the

more carbon key atoms of polymer, the stronger the tensile strength thereof. The polymer appears as if all are rectangular keys in the drawings but in fact there is a certain angle between two adjoining carbon keys, so such polymer will have an extremely high stretching magnitude when subject to tension.

In producing a conventional polymer pre-stretched grid it is intended to eliminate the said angle of carbon keys, and through the effect of directional disposition, the tensile strength of polymer is considerably stepped up, and the yielding strength of polymer products achievable is between 20k - 50k psi which is almost the same as that of mild steel of which the yielding strength is 30k - 36k psi.

The foregoing conventional polymer pre-stretched grid is produced by punching a thin polymer sheet moulded by a moulding machine and then stretching each lateral row of holes one by one to form a square or rectangular grid so as to rearrange the keys of polymer molecules. The process of stretching each lateral row of holes one by one to form the grid is rather complex and slow, and so far as the stretching of grid network plies is concerned, as shown schematically in Figure 4 of the accompanying drawings, the crossings of longitudinal and transverse network plies and parts of the front and rear network plies are not stretched or not fully stretched, namely, there is a certain angle

between adjoining carbon keys of polymer in the position of the said network plies which will still have a very high stretching magnitude when subject to tension, so the unstretched and not fully stretched parts of said front and rear network plies result in a waste of polymer material. Next, since the conventional polymeric pre-stretched grid is produced by punching and stretching the thin polymer sheet automatically moulded by machine, the width thereof is limited by the width of machine (less than 6 feet normally), so when there is a need to lay same on a construction site, 10 to 30cm sides of adjoining two sheets have to be mutually overlapped, it is wasteful not only in material but also in manpower.

According to this invention there is provided a process for forming a grid of polymeric material comprising moulding a polymeric material to form relatively thin strips, stretching the strips to the required extent to rearrange the polymer molecules to form long keys resulting in strips with high tensile strength and forming a grid by bonding together longitudinally and transversely disposed or otherwise angularly disposed said strips.

Preferably the polymeric material comprises a polyolefin, e.g. polyethylene or polypropylene, or a polyester, e.g. polyethylene terephthalate. The bonding may be carried out by adhesive or by hot fusion.

Conveniently the strips are formed by extrusion.

Thus, the present invention offers a process for producing a polymeric pre-stretched grid wherein a suitable polymeric material may be automatically extruded into strips by a machine, these strips may be automatically stretched to form pre-stretched strips by a machine and may then be crossed longitudinally and transversely or otherwise angularly crossed and combined by gluing or hot fusion or other suitable process to form a pre-stretched grid whose width does not need to be limited, thereby simplifying the process, saving material and lowering the manufacturing cost.

A process for producing a grid of polymeric material illustrative of the present invention will be described as follows:

- (1) Polyethylene is fed into a moulding machine for automatic moulding to make the thin polymer strips.
- (2) The thin polymeric strips are fully and automatically stretched by a pre-stretching machine so as to rearrange the long keys of polymer molecules and form pre-stretched strips with high tensile strength.
- (3) The pre-stretched strips are longitudinally and transversely crossed in line with a pre-set width thereof by a machine (or by hand if no machine is available) and the crossings of longitudinal and transverse network plies are

combined by gluing or hot fusion to form the pre-stretched grid.

The pre-stretched grid so produced results in a product with a high tensile strength since each longitudinal and transverse network ply has been fully stretched, and it is characterised by the avoidance of neither fully stretching a certain one-way network ply nor forming a dead space of stretching network plies at the longitudinal and transverse crossings of said plies or wasting the material in the unstretched part at the said crossings.

The pre-stretched grid made as above is further characterised by the manufactured and processed width thereof not being limited by the length of machine and capable of meeting the dimensions required by the construction site or being much wider so as to save material and cost.

The pre-stretched grid made as above is still further characterised by evenly stretching the whole network plies by machine, simple manufacturing process and even and reliable quality.

The most prominent advantage of the grid made as above consists in producing the pre-stretched grid with same tensile strength because all the pre-stretched strips thereof have been fully stretched, and in comparison with the conventional polymeric pre-stretched grid wherein the

material is wasted in the unstretched part at the crossings of longitudinal and transverse network plies, approximately one third of the material may be saved.

CLAIMS

1. A process for forming a grid of polymeric material comprising moulding a polymeric material to form relatively thin strips, stretching the strips to the required extent to rearrange the polymer molecules to form long keys resulting in strips with high tensile strength and forming a grid by bonding together longitudinally and transversely disposed or otherwise angularly disposed said strips.
2. A process according to Claim 1, wherein the polymeric material comprises a polyolefin.
3. A process according to Claim 2, wherein the polymeric material comprises polyethylene or polypropylene.
4. A process according to Claim 1, wherein the polymeric material comprises a polyester.
5. A process according to Claim 4, wherein the polymeric material comprises polyethylene terephthalate.
6. A process according to any preceding claim, wherein the bonding is carried out using adhesive.

7. A process according to any one of Claims 1 to 5, wherein the bonding is carried out by hot fusion.
8. A process according to any preceding claim, wherein the strips are formed by extrusion.
9. A process according to Claim 1 substantially as herein described and exemplified.

Amendments to the claims have been filed as follows

1. A process for forming a grid of polymeric material comprising moulding a polymeric material to form relatively thin strips, stretching the strips to the required extent to rearrange the polymer molecules to form long bonds resulting in strips with high tensile strength and forming a grid by bonding together longitudinally and transversely disposed or otherwise angularly disposed said strips.
2. A process according to Claim 1, wherein the polymeric material comprises a polyolefin.
3. A process according to Claim 2, wherein the polymeric material comprises polyethylene or polypropylene.
4. A process according to Claim 1, wherein the polymeric material comprises a polyester.
5. A process according to Claim 4, wherein the polymeric material comprises polyethylene terephthalate.
6. A process according to any preceding claim, wherein the bonding is carried out using adhesive.

-12-

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(ii) Int Cl (Edition 5) B29D 28/00; D04H 3/00, 3/04,
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Databases (see over)

(i) UK Patent Office

(ii)

Search Examiner

ALEX LITTLEJOHN

Date of Search

23 JULY 1992

Documents considered relevant following a search in respect of claims

1-9

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
A	GB 2109427 A (CONWED) - see whole document	-
A	GB 1289716 (NALLE) - see whole document	-
X	EP 0344318 A1 (HAGIHARA) - see whole document eg figures 1,2 and page 13 line 25 - page 14 line 1	1-8

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

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E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

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